What is claimed is:

1. A contrast compensation apparatus, comprising:

a pixel value detection unit to detect a distribution of pixel values of respective pixels of an input image signal;

a pixel value limit unit having pre-set luminance limit values and being coupled to the pixel value detection unit, re-configuring the distribution of the pixel values of the respective pixels based on the pre-set luminance limit values; and

a mapping unit, coupled to the pixel value limit unit, to set a luminance of the respective pixels based on a cumulative distribution function with respect to the re-configured pixel values.

2. The contrast compensation apparatus as claimed in claim 1, wherein the pre-set luminance limit values include:

a first setting value to set an upper limit of the detected pixel values of the respective pixels; and

a second setting value to set a lower limit of the detected pixel values of the respective pixels.

3. The contrast compensation apparatus as claimed in claim 2, wherein the pixel value limit unit includes:

a first comparison part to compare the pixel values of the respective pixels detected from the pixel value detection unit with the first setting value, and to output the first setting value when the detected pixel values exceed the first setting value; and

a second comparison part to compare the pixel values of the respective pixels detected from the pixel value detection unit with the second setting value, and to output the second setting value when the detected pixel values of the respective pixels are smaller than the second setting value.

4. The contrast compensation apparatus as claimed in claim 3, wherein the first comparison part includes:

a first buffer having an input terminal from which an image signal is inputted, and an output terminal connected to an output terminal of the first comparison part;

a first storage to store a first setting value; and

a first comparator to compare the image signal with the first setting value of the first storage, and, based on a result of the comparison, enable one of:

the first buffer so that the detected pixel value is outputted to the second comparison part; and

the first storage so that the first setting value is outputted to the second comparison part.

5. The contrast compensation apparatus as claimed in claim 4, wherein the second comparison part includes:

a second buffer having an input terminal to receive output from the first comparison part, and an output terminal connected to an output terminal of the second comparison part;

a second storage to store a second setting value; and

a second comparator to compare the output from the first comparison part with the second setting value of the second storage, and, based on a result of the comparison, to enable one of:

the second buffer so that the output value of the first comparison part is outputted from the pixel value limit unit; and

the second storage so that the second setting value is outputted from the pixel value limit unit.

6. The contrast compensation apparatus as claimed in claim 5, further comprising a cumulative distribution function conversion unit located between the pixel value limit unit and the mapping unit, converting the image signal based on the Formula below with the cumulative distribution function of pixel values re-configured in the pixel value limit unit:

$$CDF(K) = CDF(K) - \frac{CDF(N)}{N \times K} + K ,$$

wherein N is the highest pixel value displayable when the image signal forms an image, and K denotes a pixel value.

7. The contract compensation apparatus as claimed in claim 1, wherein the pixel value is one among the brightness value, a grayscale value of three primary colors R, G, B and a grayscale value of color difference signals Y, Cb, Cr.

8. A contrast compensation method, comprising:

calculating pixel values of an image signal;

limiting the calculated pixel values based on pre-set luminance limit values, and re-configuring the calculated pixel values of the image signal; and

calculating a cumulative distribution function to reconfigure the calculated pixel values, and setting contrast of the image signal based on the cumulative distribution function.

9. The contrast compensation method as claimed in claim 8, wherein the operation of re-configuring the calculated pixel values comprises:

setting an upper limit value of the calculated pixel values;

setting a lower limit value of the calculated pixel values; and

mapping the calculated pixel values greater than the upper limit value and the calculated pixel values less than the lower limit value into the upper limit value and the lower limit value, respectively.

10. The contrast compensation method as claimed in claim 9, wherein the setting of the contrast of the image signal comprises:

converting the cumulative distribution function into a predetermined gray level; and

mapping the calculated pixel values of the image signal based on the cumulative distribution function converted to the predetermined gray level.

11. The contrast compensation method as claimed in claim 10, wherein the mapping operation comprises:

dividing the cumulative distribution function by a number of pixels forming the image signal; and

multiplying by the predetermined gray level, the cumulative distribution function divided by the number of pixels.

12. The contrast compensation method as claimed in claim 11, wherein the setting of the contrast of the image signal further includes calculating the cumulative distribution function of the calculated pixel values and re-configuring the cumulative distribution function based on a Formula as set forth below:

$$CDF(K) = CDF(K) - \frac{CDF(N)}{N \times K} + K$$

where N is a highest pixel value displayable when the image signal forms an image, and K denotes a pixel value.

13. The contrast compensation method as claimed in claim 8, wherein the pixel value is one among the brightness value, a grayscale value of three primary colors R, G, B and a grayscale value of color difference signals Y, Cb, Cr.

14. A computer-readable medium, having stored thereon computer-executable instructions of a contrast compensation method, comprising:

calculating pixel values of an image signal;

limiting the calculated pixel values based on pre-set luminance limit values, and re-configuring the calculated pixel values of the image signal; and

calculating a cumulative distribution function to reconfigure the calculated pixel values, and

setting a contrast of the image signal based on the cumulative distribution function.

15. The computer-readable medium as claimed in claim 14, wherein the operation of calculating a cumulative distribution function to reconfigure the calculated pixel values comprises:

setting an upper limit value of the calculated pixel values;

setting a lower limit value of the calculated pixel values; and

mapping the calculated pixel values greater than the upper limit value and the calculated pixel values less than the lower limit value into the upper limit value and the lower limit value, respectively.

16. The computer-readable medium as claimed in claim 14, wherein the operation of setting the contrast of the image signal comprises:

converting the cumulative distribution function into a predetermined gray level; and

mapping the calculated pixel values of the image signal based on the cumulative distribution function converted to the predetermined gray level.

17. The computer-readable medium as claimed in claim 16, wherein the mapping operation comprises:

dividing the cumulative distribution function by a number of pixels forming the image signal; and

multiplying, by the predetermined gray level, the cumulative distribution function divided by the number of pixels.

18. The computer-readable medium as claimed in claim 14, wherein the operation of setting the contrast of the image signal further includes calculating the cumulative distribution function of the calculated pixel values and re-configuring the cumulative distribution function based on a Formula as set forth below:

$$CDF(K) = CDF(K) - \frac{CDF(N)}{N \times K} + K$$

where N is a highest pixel value displayable when the image signal forms an image, and K denotes a pixel value.

19. A contrast compensation apparatus, comprising:

a probability density function (PDF) calculation unit, to detect a pixel value of respective pixels of an input image;

a Bit Under threshold Bit Over threshold (BUBO) unit, coupled to the PDF calculation unit, to set one of a first setting value and a second setting value based on the luminance degree of the respective pixels and output resulting probability functions;

a cumulative distribution function (CDF) unit, coupled to the BUBO unit, to accumulate the probability functions outputted from the BUBO unit sequentially;

a CDF compensation unit, coupled to the CDF unit, to reconfigure the accumulated probability functions according to a predetermined luminance adjustment that reduces an influence on a total luminance of an output image due to luminance of predetermined portions forming the output image; and

a mapping unit, coupled to the CDF compensation unit and to receive the input image, to store reconfigured CDFs and map and output pixel values of the input image according to the reconfigured CDFs.

20. The contrast compensation apparatus of claim 19, wherein the BUBO unit comprises:

a first comparison unit, coupled to the PDF calculation unit, to compare a first setting value with the pixel value detected by the PDF calculation unit, wherein

if the pixel value is greater than or equal to the first setting value, the first comparison unit outputs the first setting value; and

if the pixel value is less than the first setting value, the first comparison unit outputs the pixel value; and

a second comparison unit, coupled to the first comparison unit, to compare a second setting value with the pixel value from the first comparison unit, wherein

if the pixel value is less than or equal to the second setting value, the second comparison unit outputs the second setting value; and

if the pixel value is greater than the second setting value, the second comparison unit outputs the pixel value to the CDF unit.

21. The contrast compensation apparatus of claim 20, wherein the CDF compensation unit, comprises:

a pixel value detector, arranged to receive the input image, to detect a pixel value of the input image;

a multiplier, coupled to the pixel value detector, to multiply the pixel value detected by a number of pixels used to form a selected image from the input image to provide an image signal;

a barrel shifter, coupled to the multiplier, to shift the image signal by a predetermined pixel value used to form the selected image;

a subtractor, coupled to the CDF unit and to the barrel shifter, to calculate a difference between an output of the CDF unit and an output of the barrel shifter; and

an adder, coupled to the subtractor and to the pixel value detector, to add the pixel value and an output of the subtractor.